



SWEDISH
STANDARDS
INSTITUTE

SVENSK STANDARD SS-EN 10302

Fastställd 2002-06-07

Utgåva 1

Krypbeständiga stål, nickel- och kobolt- legeringar

Creep resisting steels, nickel and cobalt alloys

ICS 77.120.01; 77.140.01; 77.150.01

Språk: engelska

Tryckt i augusti 2002

Europastandarden EN 10302:2002 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN 10302:2002.

The European Standard EN 10302:2002 has the status of a Swedish Standard. This document contains the official English version of EN 10302:2002.

Dokumentet består av 48 sidor.

Upplysningar om **sakinnehållet** i standarden lämnas av SIS, Swedish Standards Institute, tel 08 - 555 520 00.

Standarder kan beställas hos SIS Förlag AB som även lämnar **allmänna upplysningar** om svensk och utländsk standard.

Postadress: SIS Förlag AB, 118 80 STOCKHOLM
Telefon: 08 - 555 523 10. *Telefax:* 08 - 555 523 11
E-post: sis.sales@sis.se. *Internet:* www.sisforlag.se

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10302

May 2002

ICS 77.120.01; 77.140.01; 77.150.01

English version

Creep resisting steels, nickel and cobalt alloys

Aciers et alliages à base de nickel et de cobalt résistant au fluage

Hochwarmfeste Stähle, Nickel- und Kobaltlegierungen

This European Standard was approved by CEN on 1 March 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	page
Foreword.....	3
1 Scope	4
2 Normative references	4
3 Terms and definitions.....	5
4 Classification and designation	5
4.1 Classification.....	5
4.2 Designation.....	5
5 Information to be supplied by the purchaser.....	6
5.1 Mandatory information •.....	6
5.2 Options ••.....	6
6 Manufacturing process	7
6.1 General ••.....	7
6.2 Delivery condition •	7
7 Requirements	7
7.1 Chemical composition.....	7
7.2 Mechanical properties	7
7.3 Creep properties	7
7.4 Surface quality	7
7.5 Dimensions and tolerances on dimensions •	8
7.6 Calculation of mass and tolerances on mass.....	8
8 Inspection and testing.....	8
8.1 General.....	8
8.2 Types and contents of inspection documents ••	8
8.3 Specific inspection and testing	9
8.4 Test methods.....	9
8.5 Retests	9
9 Marking	10
Annex A (informative) Applicable dimensional standards.....	25
Annex B (informative) Technical information on creep resisting steels, nickel and cobalt alloys.....	26
Annex C (informative) Preliminary reference data for long-term creep strength and stress rupture values	29
Annex D (informative) Guideline values for the physical properties of creep resisting steels, nickel and cobalt alloys	42
Bibliography	46

Foreword

This document EN 10302:2002 has been prepared by Technical Committee ECISS/TC 23, "Stainless steels", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

NOTE The clauses marked with a point (•) contain information relating to agreements which are to be made at the time of ordering. The clauses marked with two points (••) contain information relating to agreements which may be made at the time of ordering.

The annexes A to D are informative.

This European Standard contains a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 10302:2002 (E)

1 Scope

1.1 This European Standard covers the grades of wrought steels and alloys listed in Tables 1 and 2 which are usually employed for components and equipment, for which the main requirement is their creep resistance under mechanical long-time stressing at temperatures above 500 °C.

Also heat resisting grades given in EN 10095 may be used for similar applications if so agreed.

1.2 This European Standard specifies the technical delivery conditions for semi-finished products, for hot or cold rolled sheet/plate and strip, hot or cold formed (cold drawn) bars, rods, wire and sections.

1.3 The general technical delivery conditions specified in EN 10021 apply in addition to the specifications of this European Standard, unless otherwise specified in this European Standard.

1.4 This European Standard does not apply to components manufactured by further processing the product forms listed in 1.2 with quality characteristics altered as a result of such further processing.

1.5 This European Standard is not intended for aerospace and pressure purposes.

1.6 For steels and alloys with similar chemical composition, but intended for different applications, see the Bibliography.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 10002-1, *Metallic materials - Tensile testing - Part 1: Method of test at ambient temperature.*

EN 10002-5, *Metallic materials - Tensile testing - Part 5: Method of test at elevated temperature.*

EN 10020, *Definition and classification of grades of steel.*

EN 10021, *General technical delivery requirements for steels and iron products.*

EN 10027-1, *Designation systems for steels - Part 1: Steel names, principal symbols.*

EN 10027-2, *Designation systems for steels - Part 2: Numerical system.*

EN 10052, *Vocabulary of heat treatment terms for ferrous products.*

EN 10079, *Definition of steel products.*

EN 10095, *Heat resisting steels and nickel alloys.*

EN 10163-2:1991, *Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections - Part 2: Plate and wide flats.*

EN 10204, *Metallic products - Types of inspection documents.*

EN 10221, *Surface quality classes for hot-rolled bars and rods - Technical delivery conditions.*

EN ISO 377, *Steel and steel products - Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*.

prEN 10168, *Steel products – Inspection documents – List of information and description*.

ISO 14284, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition*.

3 Terms and definitions

For the purposes of this European Standard, the following term and definition apply in addition to the terms and definitions in EN 10020, EN 10021, EN 10052, EN 10079, EN ISO 377 and ISO 14284.

3.1

creep resisting materials

steels, nickel- or cobalt-alloys with a minimum of 8 % chromium which are characterised by good mechanical behaviour at temperatures above 500 °C under long-range service conditions; i. e. primarily by high creep strength or high rupture strength during long-time stressing

NOTE For supplementary information on creep resisting steels and alloys see annex B.

4 Classification and designation

4.1 Classification

Materials covered in this European Standard are classified according to their structure into:

- martensitic steels;
- austenitic steels;
- nickel alloys; and
- cobalt alloys.

4.2 Designation

The names and numbers of the steels (see Table 1) were formed in accordance with EN 10027-1 and EN 10027-2 respectively.

NOTE Explanation on the designation of nickel and cobalt alloys (see Table 2).

- name: The preceding chemical symbols indicate the main alloy elements and the figure immediately following indicates the average content of these alloys subsequently followed by the symbol for the other added important alloy elements.
- material number: The structure is set out according to EN 10027-2 with the number 2 for the material group number. This material group comprises chemically resistant and high temperature or heat resistant nickel and cobalt alloys.

EN 10302:2002 (E)

5 Information to be supplied by the purchaser

5.1 Mandatory information •

The following information shall be supplied by the purchaser at the time of enquiry and order:

- a) the quantity to be delivered;
- b) the designation of the product form (e. g. bar or rod, strip or plate);
- c) where an appropriate dimensional standard is available (see annex A) the number of the standard and the indications required by this, also the nominal dimensions and tolerances;
- d) the type of material (steel, cobalt or nickel alloy);
- e) the number of this European Standard (EN 10302);
- f) the name or number of the steel grade, nickel or cobalt alloy (see 4.2);
- g) if for the relevant material in the table more than one treatment condition for the mechanical properties is covered, the symbol for the desired heat treatment condition or work hardened condition;
- h) the desired process route (see symbols in Tables 5 and 6).

EXAMPLE

10 t rounds of a steel grade with the name X6NiCrTiMoVB25-15-2 and the number 1.4980 as specified in EN 10302 of 50 mm diameter, dimensional tolerances as specified in prEN 10060, in process route 1D (see Table 6).

10 t rounds prEN 10060 - 50

steel EN 10302 - X6NiCrTiMoVB25-15-2+1D

or

10 t rounds prEN 10060 - 50

steel EN 10302 - 1.4980+1D

5.2 Options ••

A number of options are specified in this European Standard and listed below. If the purchaser does not indicate his wish to implement one of these options, the supplier shall supply in accordance with the basic specification of this European Standard (see 5.1) :

- a) any requirement concerning a special melting or forming process (see 6.1);
- b) any requirement relating to surface quality (see 7.4);
- c) any requirement concerning tolerances on mass not specified in the dimensional standard (see 7.6.2);
- d) any requirement concerning the issue of an inspection document (see 8.2);
- e) any requirement concerning the method of analysis to determine the product analysis (see 8.4.1);
- f) any requirement concerning special marking of the products (see 9.2, 9.3 and Table 12).

6 Manufacturing process

6.1 General ••

Unless a special melting or forming process is agreed when ordering, the production process for steels and alloys conforming to this European Standard shall be at the discretion of the manufacturer.

6.2 Delivery condition •

The products shall be supplied in the delivery condition agreed in the order by reference to the process route given in Tables 5 and 6 and to the treatment conditions given in Tables B.1 and B.2.

7 Requirements

7.1 Chemical composition

7.1.1 The chemical composition requirements given in Tables 1 and 2 apply in respect to the cast analysis.

7.1.2 The product analysis may deviate from the limiting values for the cast analysis given in Tables 1 and 2 by the values listed in Tables 3 and 4.

7.2 Mechanical properties

7.2.1 Mechanical properties at room temperature

The mechanical properties at room temperature as specified in Tables 7 and 8 apply for each specified heat treatment condition. This does not apply to the process route 1U (hot rolled, not heat treated, not descaled) and to semi-finished products.

- If by agreement at the time of ordering the products are to be supplied in a non-heat-treated condition, the mechanical properties specified in Tables 7 and 8 shall be obtainable from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

7.2.2 Mechanical properties at elevated temperatures

The mechanical properties at elevated temperature as specified in Tables 9 and 10 apply for each specified heat treatment condition. This does not apply to the process route 1U (hot rolled, not heat treated, not descaled) and to semi-finished products.

- If by agreement at the time of ordering the products are to be supplied in a non-heat-treated condition, the mechanical properties specified in Tables 9 and 10 shall be obtainable from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

7.3 Creep properties

The creep or stress requirements as specified in annex C apply for each specified heat treatment condition. This does not apply to the process route 1U (hot rolled, not heat treated, not descaled) and to semi-finished products.

7.4 Surface quality

Slight surface imperfections, inherent in the production process, are permitted.

- If more exact requirements for the surface quality are necessary, this shall be agreed at the time of enquiry and order.

EN 10302:2002 (E)

When products are delivered in coil form, the degree and extent of such imperfections may be expected to be greater, due to the impracticability of removing short lengths of coil. For hot-rolled quarto-plates, the specification in EN 10163-2:1991, class A3, applies unless otherwise agreed.

For long products, where appropriate, the requirements shall be on the basis of EN 10221.

7.5 Dimensions and tolerances on dimensions •

The dimensions and the tolerances on dimensions are to be agreed at the time of enquiry and order, as far as possible with reference to the dimensional standards listed in Annex A.

7.6 Calculation of mass and tolerances on mass

7.6.1 When calculating the nominal mass from the nominal dimensions the values given in Tables D.1 and D.2 shall be used as a basis for the density of the grade concerned.

7.6.2 •• If the tolerances on mass are not specified in the dimensional standard listed in Annex A, they may be agreed at the time of enquiry and order.

8 Inspection and testing

8.1 General

The manufacturer shall carry out appropriate process control, inspection and testing to assure himself that the delivery complies with the requirements of the order.

This includes the following:

- a suitable frequency of verification of the dimensions of the products,
- an adequate intensity of visual examination of the surface quality of the products,
- an appropriate frequency and type of test to ensure that the correct grade is used.

The nature and frequency of these verifications, examinations and tests is determined by the manufacturer, in the light of the degree of consistency that has been determined by the evidence of the quality system. In view of this, verifications by specific tests for these requirements are not necessary unless otherwise agreed.

8.2 Types and contents of inspection documents ••

8.2.1 At the time of ordering the issue of one of the inspection documents in accordance with EN 10204 may be agreed for each delivery.

8.2.2 If it is agreed to issue a test report 2.2 in accordance with EN 10204 it shall indicate the following information:

- a) the information groups A, B and Z of prEN 10168;
- b) the results of the cast analysis in accordance with the code numbers C71 to C92 in prEN 10168.

8.2.3 If the issuing of an inspection certificate 3.1.A, 3.1.B or 3.1.C according to EN 10204 or of an inspection report 3.2 according to EN 10204 has been agreed, specific inspections according to 8.3 are to be carried out and the following information shall be given in the inspection document with the code numbers and details required by prEN 10168:

- a) as under 8.2.2 a);
- b) as under 8.2.2 b);
- c) the results of the mandatory tests marked in Table 11, second column, by an "m";
- d) the result of the optional tensile test at elevated temperature marked in Table 11, second column, by an "o" and of any other optional test or inspection agreed when ordering.

8.3 Specific inspection and testing

8.3.1 Extent of testing

The tests to be carried out, either mandatorily (m) or by agreement (o) and the composition and size of the test units, and the number of sample products, samples and test pieces to be taken are given in Table 11.

8.3.2 Selection and preparation of samples and test pieces

8.3.2.1 The specifications of EN ISO 377 and ISO 14284 respectively shall be observed in sampling and sample preparation. The stipulations in 8.3.2.2 apply additionally for the mechanical tests.

8.3.2.2 The test samples for the tensile test shall be taken in accordance with Figures 1 and 2 in such a way that for flat products, they are located half-way between the centre and a longitudinal edge.

The samples shall be taken from products in the delivery condition. If agreed, the samples may be taken before flattening for flat products or before straightening for bars. For samples to be given a simulated heat treatment the conditions for annealing, hardening and tempering shall be agreed.

8.4 Test methods

8.4.1 •• Unless otherwise agreed when ordering, the choice of a suitable physical or chemical method of analysis to determine the product analysis is at the discretion of the manufacturer. In cases of dispute the analysis shall be carried out by a laboratory approved by the two parties. The method of analysis to be used shall be agreed, where possible with reference to appropriate European Standards or EURONORMS.

8.4.2 The tensile test at room temperature shall be carried out in accordance with EN 10002-1. Generally, this means using proportional test pieces having a gauge length $L_0 = 5,65 \sqrt{S_0}$. (S_0 = cross-section of the test piece). In cases of doubt and in referee testing this type of test piece shall be used.

The 0,2 % proof strength, the tensile strength and elongation after fracture shall be determined.

8.4.3 If agreed when ordering, the tensile test at elevated temperature shall be carried out in accordance with EN 10002-5, this generally being with proportional test pieces having a gauge length $L_0 = 5,65 \sqrt{S_0}$. (S_0 = cross-section of the test piece). In cases of doubt and in referee testing these test pieces shall be used. The temperature of testing is to be agreed.

The 0,2 % proof strength shall be determined.

8.4.4 Dimensions and dimensional tolerances of the products shall be tested in accordance with the requirements of the relevant dimensional standards, where available.

8.5 Retests

See EN 10021.